OPERATOR'S MANUAL

SPECTROLINE®

Ultraviolet Germicidal Irradiation (UVGI) Cabinets

HCL-1000 and HCL-1500

SPECTRONICS CORPORATION

www.spectroline.com

956 Brush Hollow Rd, Westbury, NY 11590 USA

800-274-8888 • 516-333-4840

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BACKGROUND:
UV-C light is effective against all pathogens. However, the level of UV exposure needed for effective treatment will vary from pathogen to pathogen as defined by level of disinfection (UV dose, log reduction, pathogen type). Many variables such as surface textures, particulates, targeted geometry, and treatment goals must be considered for inactivation of germs. Some microorganisms are very easy to treat with a minimal UV dose, others are more resilient and may need extensive levels of UV exposure.

An effective method of decontaminating Filtering Facepiece Respirators (FFR) should be to reduce the pathogen burden, maintain the function of the FFR and present no residual hazard. The ability of respirator filter media to withstand ultraviolet germicidal irradiation (UVGI) varies by manufacturer. In the absence of guidance or information from FFR manufacturers, respirators may still be decontaminated and be worn for any patient care activities, except during aerosol generating procedures. Decontamination and subsequent reuse of FFRs should only be practiced as a crisis capacity strategy*. Learn more about COVID-19 and prevention of its spread from the CDC and WHO.

*www.cdc.gov/coronavirus/2019-ncov/hcp/ppe-strategy/decontamination-reuse-respirators.html

This manual provides general guidelines for usage of Spectroline® microprocessor- controlled UVGI Cabinets, models HCL-1000 and HCL-1500 for sanitization of FFR, specifically that of N95 masks. The recommendations are based on research data publicly reported and not on actual testing performed by any independent lab on behalf of Spectronics Corporation.


WARNING

The UVGI Cabinets are designed exclusively for the purposes described in this manual. Never use this equipment in any manner not specified in these instructions because the protection provided by the equipment may be impaired.

Please read the instructions in this manual carefully before using the UVGI Cabinets.

UNPACKING AND INSPECTION

Carefully unpack the UVGI Cabinet and inspect for damage. If any damage is noted, do not attempt to operate the unit and immediately notify the carrier and supplier.

We recommend that you save your carton and all packing materials to safely pack and ship the UVGI Cabinet should it ever require service.

The tubes are protected during shipment by foam blocks. Remove them from the chamber.

Connect the power cord provided to the rear panel of the unit.

Make sure the UVGI Cabinet operates correctly by putting it through each of the OPERATING MODES on pages 6-7.

NOTE: The UVGI Cabinet door is made of a special, transparent UV-blocking material so that the user can safely observe the operation. The door has a built-in safety interlock which automatically shuts off the UV tubes when the door is not securely closed. Never use the UVGI Cabinet with the safety interlock bypassed. Moreover, the door seals must be kept clean, even from cleaner residue. Do not spill any liquid inside the chamber. When loading samples, take care not to block the photo sensor located inside the chamber at the rear.

Exposure to ultraviolet irradiation without proper protection can be hazardous to the eyes and skin.

SPECIFICATIONS

	HCL-1000	HCL-1500
UV Tubes	(5) 8-watt 254nm	(6) 15-watt 254nm
Net Capacity for N95 Masks	3	6
Overall Housing Dimensions — W x H x D	19.5 x 10.5 x 9 in (49.5 x 26.7 x 22.9 cm)	24 x 10.5 x 14 in (61.0 x 26.7 x 35.6 cm)
Effective Inner Chamber Dimensions — W x H x D	13.5 x 7 x 7.5 in (34.3 x 17.8 x 19.1 cm)	18.25 x 6.25 x 12.5 in (46.4 x 15.9 x 31.8 cm)
Net Weight	17.5 lb (7.9 kg)	26 lb (11.8 kg)

Voltage: All models available in 230V/50Hz or 100V/50-60Hz
Irradiance Display Resolution: +/- 5μW/cm^2 over the entire range

CONTROL PANEL DISPLAY DESCRIPTION

1. **Power** — ON/OFF switch. When "ON," the UVGI Cabinet electronics are in the WAKE state before receiving value or operational mode instructions.
2. **Time** — Enter time up to 9,999 seconds. NOTE: The minimum interval for value entry is 1 second.
3. **Energy** — Select energy dose up to 0.9999 J/cm^2. NOTE: The minimum interval for value entry is 100 µJ/cm^2 (0.1 mJ/cm^2).
4. **Intensity** — Measures UV irradiance inside the chamber.
5. **Start** — Initiates the selected operation (i.e., ENERGY, TIME, or INTENSITY). This pad turns on the UV tubes after the mode and value are entered.
6. **Reset** — Clears all previously entered instructions and returns the UVGI Cabinet electronics to the WAKE state.
7. **Numeral Pads** — Selects desired time or energy level. This must be done after mode selection.
8. **X100 µJ/cm^2** — Lit LED indicates "ENERGY" mode operation.
9. **Seconds** — Lit LED indicates "TIME" mode operation.
10. **µW/cm^2** — Lit LED indicates "INTENSITY" mode operation.
11. **Display** — Displays selected values of time, energy, or intensity level as well as the following useful prompts: "DOOR" for open door, "BULB" for intensity level under 1,500 µW/cm^2, and "END" for completed operation.

OPERATING MODES

The user can operate the UVGI Cabinet in any of the four modes mentioned in this section. An audible beep confirms each key entry *to avoid errors or accidental entries.* Press ‘‘RESET’’ at any time to abort any operation or to correct an error. The function must be selected before the value is entered. If the value is entered first, it will have to be re-entered after the function is selected.

NOTE: We recommend a five-minute warm-up period, from a cold start, before using the unit. This allows the UV tubes to stabilize for more accurate operation. We recommend an intensity check each day before using the UVGI Cabinet to ensure that it operates at proper intensity. The UV tubes must be replaced periodically since their intensity output declines with use. If unit displays “BULB,” refer to 3. Intensity Mode.

1. **Energy Mode** — When the UVGI Cabinet is in the ENERGY mode, the X100 μJ/cm^2 LED lights. The value displayed or to be entered is in microjoules per unit area. Energy dosage may be set using the number pad to a maximum of 0.9999 J/cm^2. The minimum interval for value entry is 100 μJ/cm^2. A built-in UV integrator computes the energy dosage delivered, thereby *automatically* compensating for the decline in UV intensity output of the tubes as they age.

   The desired dosage should be entered on the number pad after pressing the ‘‘ENERGY’’ pad. Press ‘‘START’’ to begin operation. After the dosage is delivered, the UVGI Cabinet beeps four times and the display flashes ‘‘END.’’ Open the door at this point, and the display will oscillate between ‘‘DOOR’’ and ‘‘0.’’

   The UVGI Cabinet is designed to make repetitive operations easy. So, when the door is closed after an operation, the UVGI Cabinet remains in the ENERGY mode and displays the last energy dosage entered. To repeat the previous dosage, just press ‘‘START.’’

   To alter a previously entered dosage, press ‘‘RESET,’’ enter the new value and then press ‘‘START’’ to begin the operation.

   When the chamber door is opened during an operation, the display will oscillate between ‘‘DOOR’’ and the energy dose remaining. To resume the operation, close the door and press

“START.” Otherwise, press “RESET” to return the electronics to the WAKE state.

2. Intensity Mode — To initiate this mode, press “INTENSITY” and then “START.” The value displayed is the irradiance level at the center of the chamber. The unit remains on until “RESET” is pressed, returning the electronics back to the WAKE state. When the UVGI Cabinet is in the INTENSITY mode, the $\mu W/cm^2$ LED lights. All the number keys are deactivated in this mode.

In this mode, the unit displays “BULB” when the intensity level falls below 1,500 $\mu W/cm^2$, indicating that the UV tubes need replacement. When the chamber door is opened during the operation, the display oscillates between “DOOR” and “0.” Then, if the door is closed, the UVGI Cabinet will remain in the INTENSITY mode. Press “START” to resume operatioor “RESET” to return the electronics to the WAKE state.

3. Time Mode — When this mode is selected, the SECONDS LED lights to indicate that the value displayed or to be entered represents seconds. Enter the exposure time desired to a maximum of 9,999 seconds (2 hours, 46 minutes and 39 seconds). The minimum value that can be entered is one second.

The desired time should be entered on the number pad after the “TIME” pad is pressed. Press “START” to begin operation. After the time has expired, the UVGI Cabinet beeps four times and the display flashes “END.” Open the door at this point and the display will oscillate between “DOOR” and “0.”

If you want to repeat the previous operation, just close the door and press “START.” The UVGI Cabinet remains in the TIME mode and displays the last time entered.

To alter a previously entered time, press “RESET,” enter the new value and then press “START” to begin the operation.

When the chamber door is opened during an operation, the display will oscillate between “DOOR” and the time remaining. To resume the operation, close the door and press “START.” Otherwise, press “RESET” to return to the WAKE state.

FOR SANITIZATION USE

The guidelines below are based on research data publicly reported for UVGI on FFR and not on actual testing performed by any independent lab on behalf of Spectronics Corporation. Number of UVGI cycles with 90-100% passing rate will vary with type of FFR and can only be determined by acceptable criteria within each facility.

Microbe	Reported Dose	Reference
H1N1 Influenza	1 J/cm^2	Mills, D., et al., Ultraviolet germicidal irradiation of influenza-contaminated N95 filtering facepiece respirators. Am. J of Infection Control, 2018. 46(7): p.e49-55
H5N1 Influenza	1.35 J/cm^2	Lore, M., et al Effectiveness of the Three Decontamination Treatments against Influenza Virus Applied to Filtering Facepiece Respirators, Ann. Occup. Hyg., 2011. 56(1): p.92-101
H1N1 Influenza	198 mJ/cm^2	Heimbuch B.K., et. al., A pandemic influenza preparedness study: use of energetic methods to decontaminate filtering facepiece respirators contaminated with H1N1 aerosols and droplets. Am. J of Infection Control, 2011. 39(1): p e1-e9
MS2 coliphage	4707 J/m^2	Fisher, E.M. and R.E. Shaffer, A method to determine the available UV-C dose for the decontamination of filtering facepiece respirators. J of Applied Microbiology, 2011. 110(1): p.287-295

UVGI CABINETS

Reported Dose	HCL-1000 (Standard) Average Time Input	HCL-1500 (Large) Average Time Input
1 J/cm^2	182 seconds per side	278 seconds per side
1.35 J/cm^2	375 seconds per side	250 seconds per side
198 mJ/cm^2	36 seconds per side	55 seconds per side
4707 J/m^2	86 seconds per side	131 seconds per side

INSTRUCTIONS:

1. With UVGI cabinet warmed up, obtain daily UV intensity output with INTENSITY mode (referenced in Mode #2 on page 7). We recommend this be performed a minimum of once per day or week.
2. Calculate irradiation time with formula below or use minimum time listed in chart on previous page.

Energy per unit area (µJ/cm^2) = Intensity (µW/cm^2) x Time (seconds)
1mJ (millijoule) = 1000µJ (microjoules)

3. UVGI must be accomplished on both sides of masks to be fully sanitized. Place masks towards center of cabinet floor. Tuck bands

under the masks. For HCL-100, place 3 masks in triangular shape. For HCL-1500, place 6 masks in 2 rows of 3. Close door securely.

4. Select “TIME” mode, enter dosing time (in seconds), press “START”. Display will time elapsing during irradiation. Sanitization will automatically stop when time has elapsed. (Refer to Time Mode on page 7.)

5. Open door and with clean gloves on, turn masks to other side in same configuration as before. Repeat step 4.

UVC APPLICATIONS IN RESEARCH

CROSSLINKING OF DNA/RNA

The UVGI can be used to covalently bind nucleic acids to membranes after Northern, Southern, slot or dot blotting, and colony or plaque lifts. Studies [1,2,3] indicate that 120 mJ/cm^2 is the optimal dosage for attachment of DNA or RNA in any of these procedures to nylon or nitrocellulose membranes. In order to obtain the best results following the DNA or RNA transfer step, the membrane should be placed inside the UVGI cabinet after the membrane is dried. Place the membrane with the side to which the nucleic acids are attached facing upwards (i.e. towards the light source) so that the nucleic acids are directly irradiated. Select an energy value or press ‘‘OPTIMAL CROSSLINK’’ followed by ‘‘START’’ to initiate the desired function.

NICKING DNA

The UVGI can be used to nick the ethidium-bromide-stained DNA in agarose gels in place of a depurination wash [4].

GENE MAPPING

The UVGI can be used to create thymine dimers prior to treatment with a restriction enzyme. The formation of dimers at or near the recognition site inhibits cleavage [5].

TESTING AND SCREENING RecA

The UVGI can be used for testing and screening RecA mutation which can prevent repair of UV-induced damage on cells, thereby retarding their growth [6].

UV SANITIZATION

When the UVGI is equipped with short wave (254nm) tubes, various sterilization processes can be undertaken for laboratory purposes [7,8,9].

ELIMINATING PCR* CONTAMINANTS

The UVGI can be used to eliminate contaminants that may occur during PCR tests [10,11,12].

REFERENCES

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CLEANING PROCEDURE

Immediately clean all spilled materials from the UVGI Cabinet and wipe dry. If necessary, moisten a cloth with soap and water and clean the unit. Do not use any harsh chemical cleaners. Do not attempt to clean the unit while it is plugged into a power source.

TROUBLESHOOTING

1. If the display does not light:
   a. Make certain that the power cord is properly plugged into the wall outlet and the back of the unit.
   b. Check the fuse inside the line-filter housing. The fuse can be accessed from the back of the unit. If blown, unplug the unit and replace with a 2A F fuse in the HCL-1000 models and a 5A F fuse in the HCL-1500 model. See ELECTRICAL SPECIFICATIONS.

2. If the display does not count after "START" is pressed:
   Mode (ENERGY, TIME or INTENSITY) and/or value have not been selected.

3. If the countdown is slower than normal:
   a. Be sure that the UV sensor is not blocked during operation.
   b. Look through the window in the chamber door during unit operation to see if all the tubes are lit. And, in the INTENSITY mode, make sure the irradiance is greater than 1,500 $\mu W/cm^2$. Should "BULB" be displayed, the UV tubes need to be replaced.
   c. If, after changing bulbs, the unit countdown continues to be slower than normal or "BULB" is displayed, then the UVGI Cabinet should be sent back to Spectronics Corporation for recalibration.

NOTE: Over time the output of the tubes will degrade and the countdown will become slower.

TUBE REPLACEMENT

If a tube fails to operate or its UV intensity does not meet desired levels and tube replacement is necessary, take the following steps:

1. Unplug the UVGI Cabinet from the power source and allow the tubes to cool.
2. Grasp the tube by the metal bases located at each end. Applying even pressure, gently rotate the tube a quarter turn until it loosens. The tube may now be easily removed from its sockets.
3. Install the new tube by reversing the above procedure.

MAINTENANCE

The Spectroline microprocessor-controlled UVGI Cabinets are factory calibrated for monitoring the intensity inside the chamber to provide years of trouble-free operation. However, should problems eventually develop with regard to intensity measurements (as may occur with *all* light meters), the unit should be returned to Spectronics Corporation for recalibration. Be sure to contact the Customer Service Department at Spectronics for shipping instructions. **Do not attempt to service the unit.**

The chamber door is made of a special, transparent UV-blocking material to facilitate the viewing of all of the tubes when the unit is on. The user can replace one or more tubes should they fail to light. Replacement tubes can be purchased from Spectronics Corporation (see Ordering Information on page 12).

If the chamber output falls below 1,500 μW/cm^2 with all tubes lit, it is recommended that you replace the *complete* set of tubes.

PLEASE NOTE

The mercury in the UV tube(s) in this lamp was replaced with an amalgam (a blend of mercury with other metals). Since the amalgam uses less mercury, it is more environmentally friendly.

The amalgam ball rolling around inside the UV tube is normal, and does not indicate that the tube is damaged or defective.

ELECTRICAL SPECIFICATIONS

MODEL	VOLTS	HZ	AMPS	FUSE
HCL-1000 Series	120	60	1.0	2.0A F
HCL-1000/F Series	230	50	1.0	2.0A F
HCL-1000/J Series	100	50-60	1.0	2.0A F
HCL-1500 Series	120	60	3.0	5.0A F
HCL-1500/F Series	230	50	3.0	5.0A F
HCL-1500/J Series	100	50-60	3.0	5.0A F

ENVIRONMENTAL CONDITIONS

The Spectroline UVGI Cabinets are designed to be safe under the following conditions.

- Indoor use;
- Altitude up to 2,000 m (6,562 ft);
- Temperature 5°C to 40°C (41°F to 104°F);
- Maximum relative humidity 80% for temperatures up to 31°C (88°F) decreasing linearly to 50% relative humidity at 40°C (104°F);
- Mains supply voltage fluctuations not to exceed ±10% of the nominal voltage;
- Installation Category II;
- Pollution Degree 2.

WARRANTY

The warranty policy for the UVGI Cabinet HCL-1000 and HCL-1500 is provided on the Certificate of Limited Warranty enclosed separately with each unit.

NOTE: For assistance of any kind, including help with a unit under warranty, contact the Customer Service Department at Spectronics Corporation. In the U.S. and Canada, call toll-free 1-800-274-8888. Give full details of the difficulty and include the model and serial numbers of the unit and the date of purchase. Spectronics will make available, on request, circuit diagrams and component parts lists for any model unit.

If return of the UVGI Cabinet to the factory is deemed necessary, shipping instructions will be provided. If an estimate of charges for nonwarranty work or other service work is required, a quote will be furnished upon evaluation of the unit. Out-of-warranty service work will not be performed without customer approval.

ORDERING INFORMATION

Description	Part No.
TUBE, Replacement, 8 Watt, 254nm	BLE-8T254
TUBE, Replacement, 15 Watt, 254nm	BLE-1T155

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www.spectroline.com
956 Brush Hollow Rd, Westbury, NY 11590 USA
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